LIBRARY OF CONGRESS PERIODICAL DIVISION NOV 6 1916

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXVII NO. 19 SAN FRANCISCO, NOVEMBER 4, 1916 PER COPY, 25 CENTS

HEAT ENERGY AND ELECTRICITY.
BY E. A. WILCOX.

A NEW INVENTION FOR MEASURING CURRENTS IN CABLES.
BY. C. B. MERRICK.

TESTS OF IRRIGATION PUMPING PLANTS
BY R. H. CATES.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries
Edison Storage Battery Co.
Electric Storage Battery Co.

Boiler Feed Water Treatment
Dearborn Chemical Co.

Brushes
National Carbon Co.

Chain Drive
Morse Chain Co.

Conduit Products
Sprague Electric Co.

Expansion Bolts
Western Electric Co.

Insulators
Hemingray Glass Co.
Locke Insulator Mfg. Co.
Pierson, Roeding & Co.

Lamps
National Lamp Works.

Motors
Century Electric Co.
Wagner Electric Mfg. Co.

Piping
Pittsburg Piping & Equipment Co.

Pole Line Hardware
Baker-Joslyn Co.
Hubbard & Co.
Pierson, Roeding & Co.

Power Plants
Chas. C. Moore & Co.

Resistance Units
Ward Leonard Electric Co.

Reflectors
Pacific States Electric Co.

Transportation
Southern Pacific Co.

Turbines
Pelton Water Wheel Co.
General Electric Co.

Washing Machines
Pacific States Electric Co.

Wire and Cable
The Okonite Co.
Standard Underground Cable Co.
New York Insulated Wire Co.

Wireless Apparatus
Haller-Cunningham Co.

Wiring Devices
General Electric Co.

Alphabetical Index to Advertisers. Page 8 Where to Buy It in the West, Page 7

24 HOUR
CONTINUOUS
SERVICE

365 DAYS
OF THE YEAR

THE
OFFICE HOURS OF

DE VEAU
INTERCOMMUNICATING
TELEPHONES

TRADE DE VEAU MARK

PACIFIC STATES
ELECTRIC CO.
The Modern Electrical Supply House
LOS ANGELES OAKLAND PORTLAND
SAN FRANCISCO SEATTLE
Address our nearest house.

WE handle everything that goes into the construction of a Pole Line—from the pole itself to the Smallest Bolt. This includes all the Hardware (hot-dipped galvanized), Insulators (glass and porcelain), Pins, Arms, Wire (insulated and bare copper and iron), Anchors, Strand, etc. We carry a Complete Stock of all this material at our Three Coast Distributing Points.

BAKER-JOSLYN COMPANY
71 New Montgomery St.
911 Western Ave. Seattle
San Francisco
353 East Second St. Los Angeles

New York by Rail and Ocean
Fare same as All Rail **but includes Meals and berth on Ship**
Take
"Sunset Limited"
(No Extra Fare) from San Francisco (Ferry Station) 4:20 P. M., via
Sunset Route
to
New Orleans
and there connect with Southern Pacific's Splendid Ocean Liners, sailing
Wednesdays and Saturdays
to
NEW YORK
For Fares and Berth Reservations, Ask Agent
Southern Pacific

NOV -7 1916

©CLB369418

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXVII SAN FRANCISCO, NOVEMBER 4, 1916 NUMBER 19

[COPYRIGHT 1916 BY TECHNICAL PUBLISHING COMPANY]

HEAT ENERGY AND ELECTRICITY

BY E. A. WILCOX.

(This article gives a brief exposition of the fundamental principles of heat transfer in general and electric heating in particular. Knowledge of the points made is necessary for every salesman of heating devices. It is taken from a comprehensive text on "Electric Heating" by the author and prefaces a number of similar abstracts which will be published in these columns from time to time in the future.—The Editor.)

Demand for Heat.—The demand for heat is greatest in temperate climates where it is essential to life, health, and comfort. Economic development has progressed more rapidly in the colder climates and has brought about numerous and important social and industrial uses of heat greatly in excess of the relative increase in population.

Advantages of Electric Heat.—This demand for heat, the great lack of efficient fuel apparatus, and the many disadvantages of fuel combustion, have opened up a large field for the utilization of electric heat. Electric energy may be transformed directly into heat energy at one hundred per cent efficiency. Its use presents no such difficult problems as are inherent in the utilization of fuel. It does not vitiate the atmosphere. It is clean, safe, and sanitary. Greater quantities and more intense heat can be produced in a given space electrically than by any other means. It produces heat directly where it is to be applied. It can be measured, and controlled both as to temperature and quantity, more readily than can any other form of heat energy. It eliminates the disadvantages of fuel storage and transportation. The losses of heat that obtain in the combustion of fuel are enormous. From an economic standpoint, our rapidly depleting natural fuel resources make the use of hydroelectric energy as a heating medium a real aid to efficient progress.

Nature of Heat.—Consideration of the nature and scientific properties of heat is necessary to a thorough understanding of this subject. It is a form of energy having two essential qualities corresponding to intensity and quantity. The intensity is measured by temperature and the quantity is measured by the British thermal unit, (i.e., heat unit, or B.t.u.)

Temperature Measurement.—The property of heat called temperature is proportional to the heat intensity, and may be measured with a thermometer or a pyrometer. The sensation of feeling heat in various bodies has reference not to the actual quantity of heat in them but to their relative temperatures.

Many types of thermometers have been developed for various temperatures and classes of work, but the Centigrade and Fahrenheit scales are applied to most of those employed in modern practice. In the Fahrenheit thermometer the freezing point of water is taken at 32 degrees and the boiling point of water is taken at 212 degrees, the distance between these two points being divided into 180 degrees. In the Centigrade thermometers the freezing point of water is taken at 0 degrees and the boiling point at 100 degrees.

Temperature Fahrenheit $= 9/5 \times$ temperature deg. C. $+ 32$ deg.
Temperature Centigrade $= 5/9 \times$ temperature deg F. $- 32$ deg.

Measurement of Heat.—Heat cannot be measured directly by a thermometer but it may be measured by noting the amount that some standard is raised in temperature. Water has been universally adopted as the standard and heat is measured by its power to raise the temperature of a given weight of it. The standard unit for heat measurement, therefore, is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit, and is termed the British thermal unit.

Specific Heat.—The capacity for absorbing heat under changing temperatures varies greatly with different bodies. The same amount of heat that would raise one pound of water one degree, for instance, would raise about eight pounds of iron one degree in temperature. Specific heat is the term used to express this property of bodies. It may be defined as the number of B.t.u., or fraction thereof, required to raise the temperature of one pound of any substance one degree Fahrenheit.

A clear conception of the use of this unit of measurement is essential to the designer of heating apparatus, since it indicates the capacity for absorbing heat for a given temperature change. All the heat taken up in raising the temperature of a substance is given off when the body cools. The total heat absorbed by a body is equivalent to the product obtained by multiplying temperature difference, weight, and specific heat. It will be noted from the table in the back of the book that the specific heat of water (i.e., its heat absorbing power) is greater than that of most known substances.

Thermal Capacity.—The thermal capacity of a

substance is the quantity of heat required to raise its temperature one degree. It is the product of its specific heat and mass. As the specific heat of water is unity, fifteen pounds of water has a thermal capacity of $15 \times 1 = 15$ B.t.u. Likewise the specific heat of cast iron being .1298, fifteen pounds of iron has a thermal capacity of $15 \times .1298 = 1.947$ B.t.u.

The Calorie.—Heating calculations are frequently expressed in calories instead of British thermal units. The French thermal unit, or calorie, is that quantity of heat required to raise the temperature of one kilogramme of water one degree Centigrade. It is equivalent to 3.968 British thermal units; or one British thermal units is equal to .252 calorie.

Mechanical Equivalent of Heat.—Heat and mechanical energy are mutually convertible. The number of foot-pounds of mechanical energy equivalent to one British thermal unit is the mechanical equivalent of heat. It has been established experimentally that one B.t.u. is equal to 778 foot-pounds, and on that basis it has been calculated that one horsepower is equivalent to 2545 B.t.u. per hour.

Relation to Electrical Units.—Where resistance is offered to the flow of an electric current the electric energy is converted into heat energy. The heat generated is proportional to the resistance of the conductor, the square of the current strength, and the length of time the current flows. It has been established experimentally that one ampere of current flowing through a resistance of one ohm for one hour will generate 3.412 B.t.u.. Since one ampere flowing one hour through a resistance of one ohm is equivalent to one watt-hour, 3.412 B.t.u. equals one watt-hour ($EIT = RI^2T$) or 3412 B.t.u. equals one kilowatt hour.

If it is desired to raise a certain quantity of a substance through a certain temperature range the number of kilowatt hours required for the operation may be calculated as follows:

$$\text{Kw-hr.} = \frac{\text{Degrees rise F.} \times \text{Pounds} \times \text{Specific Heat}}{\text{\% Efficiency} \times 3412}$$

Divide the number of kilowatt hours determined by the above calculations by the number of hours allowed for the operation and the result will be the kilowatts of heater capacity required for performing the work.

Latent Heat.—The quantity of heat which is absorbed by a body in a given state in converting it into another state without changing its temperature is termed its latent heat.

Latent heat of fusion is the heat absorbed in changing a body of a certain weight from a solid to a liquid without changing its temperature. When the operation is reversed the same quantity of heat is given off as was previously absorbed.

Latent heat of evaporation is the heat required to change a unit weight of a solid or liquid at a given temperature into a gaseous state at the same temperature. It is the heat that disappears during the change and which will reappear if the operation is reversed. Whereas it requires only 180 B.t.u. at atmospheric pressure to heat a pound of water from the freezing to the boiling point (termed sensible heat), it requires 970 B.t.u. (latent heat of evaporation) to convert the same quantity of water into steam at 212 degrees F.

The total heat of evaporation is the sum of the sensible heat and the latent heat of evaporation.

Radiation.—Heat passes from warm to cold bodies by three general methods,—radiation, conduction, and convection. Radiation of heat takes places between bodies at all distances apart and the heat rays proceed in straight lines until intercepted or absorbed by some object. The amount of heat transmitted varies inversely as the square of the distance from the source. The rate at which heat is given off or absorbed depends upon the character of the surfaces of the bodies as well as upon their relative temperatures. Dark and rough surfaces radiate and absorb heat more readily than smooth and polished ones. Radiant heat passing through air or other gases does not affect their temperature to any appreciable extent.

Conduction.—The transfer of heat between two bodies or parts of a body in direct contact with one another is termed conduction. It differs from radiant heat in that it does not necessarily travel in straight lines, and in its gradual rather than instantaneous transfer. The quantity of heat conducted is proportional to the cross sectional area, to the temperature difference, and to the character of the material.

Metals are, in general, better conductors of heat than other materials, although they vary to a very great extent. The conducting power of stone is less than one per cent that of copper, and iron is about 3500 times as good a conductor as air.

Convection.—The transfer and diffusion of heat in a fluid mass through the motion of the particles of the mass is termed the convection of heat. The particles must be in constant motion in order to insure uniform temperature of the mass. When the particles come into contact with hot bodies the mass will be warmed in proportion to the freedom of circulation in the fluid.

Air is usually heated in a room by circulation of the air particles and bringing them into contact with heated surfaces. The better the circulation of air against these surfaces the more uniform will the room temperature become.

Comparisons of Fuel and Electric Heat.—The relative heating values of fuels are often compared with electric heat. For instance, it may be shown that with coal having a heating value of 14,000 B.t.u. per pound and costing $5 per ton, manufactured gas having a heating value of 600 B.t.u. per cu. ft. and costing $1 per thousand cu. ft. and electricity having a heating value of 3412 B.t.u. per kilowatt hour and costing one cent per kilowatt hour, one cent will buy 56,000 B.t.u. of coal heat, 6000 B.t.u. of gas heat, and 3412 B.t.u. of electric heat. However, the fact must not be overlooked that all fuel apparatus is naturally less efficient than electric apparatus. With average efficiencies of say 10 per cent for coal, 20 per cent for gas, and 70 per cent for electric apparatus, the purchasing power of one cent under the above assumed prices and heating values would be 5600 B.t.u. of coal heat, 1200 B.t.u. of gas heat, and 2388 B.t.u. of electric heat.

The following table will be of assistance in making hasty comparisons of the B.t.u. value of fuel and electric heat. Efficiencies lower than 50 per cent are seldom, if ever, encountered in electric applications and are therefore omitted from the table.

B.t.u. Purchasing Power of One Cent.

Efficiency of Apparatus in %.....	100	75	50	30	20	10
14,000 B.t.u. Coal—						
$ 5.00 per ton.....	56,000	42,000	28,000	16,800	11,200	5,600
$10.00 per ton.....	28,000	21,000	14,000	8,400	5,600	2,800
600 B.t.u. Gas—						
$1.00 M. cu. ft.....	6,000	4,500	3,000	1,800	1,200	600
$1.50 M. cu. ft.....	4,500	3,375	2,250	1,350	900	450
Electricity—						
1c per kw.-hr.....	3,412	2,559	1,706	....	....	...
2c per kw.-hr.....	1,706	1,279	853	....	....	...
3c per kw.-hr.....	1,137	853	568	....	....	...
5c per kw.-hr.....	682	512	341	....	....	...

Actual experience proves that many careful calculations do not work out in practice. One might assume from the above figures, for instance, that the cost of using a gas range would be at least five times as great as the cost of using a coal range. We know, however, that the average cost for cooking is less with gas than with coal under the prices assumed.

Cost should not be the only consideration in determining the best method to adopt. Improvement of product, elimination of waste, increased safety, saving of labor and skill, greater comfort and cleanliness, possibility of performing new and otherwise impossible operations, are all essential economic advantages that accrue to the user of electric heat.

RESULTS OF LAST YEAR'S PROSPERITY WEEK.

Here are a few results of last year's Electrical Prosperity Week:

It was the greatest publicity campaign ever carried out.

The President of the United States endorsed it.

Big magazines issued Electrical Numbers.

Record crowds at parades; 70,000 viewed parade in one city.

Brought electricity before the public as never before.

Electrical shows held in 30 cities.

Advanced commercial spirit of the industry five years.

Brought better co-operation between central stations and dealers everywhere—and better co-operation between the public and the public utilities.

One manufacturer alone sold $100,000 worth of goods as a direct result of the "Week."

7,649,200 pieces of E. P. W. literature were sent out.

These records will be smashed by A. E. W. 1916.

Already advertising has reached a giant stature; it is a Samson of restored and multiplied strength whose eyes have been opened to a vision of his own responsibility and power.

Among the things that appear in this vision are the amazing possibilities of advertising applied in fields at present hardly pre-empted—the service of the nation in its varied needs; the service of the church and every accepted means of moral and social improvement; the service of big business and of little business, in going direct to the people and stating their case openly as man to man.

With "Truth in Advertising" clearly and universally recognized as being as truly intelligent as it is honest, men of the widest vision may well hesitate to fix a deadline of achievement in the service of mankind beyond which this great modern force may not go!

A NEW INVENTION FOR MEASURING CURRENTS IN CABLES.

BY C. B. MERRICK.

It is an undisputed fact that the present day metering of large direct current loads is both cumbersome and expensive. This is due to the necessity of building the meters so that they will carry the full line current to be measured, or to the necessity of connecting them with heavy shunts which are inserted in the line. The shunt method is liable to include the errors due to change in resistance which may be caused by change in contact, uneven temperatures on shunt and meter, etc. In addition to the first cost of installation, the maintenance cost of these meters is high, and the periodic checking necessary for accurate results is exceedingly laborious because of the requirement that the tests be made without discontinuing service, whereas installing a standard check meter in series without a shutdown is a painstaking process.

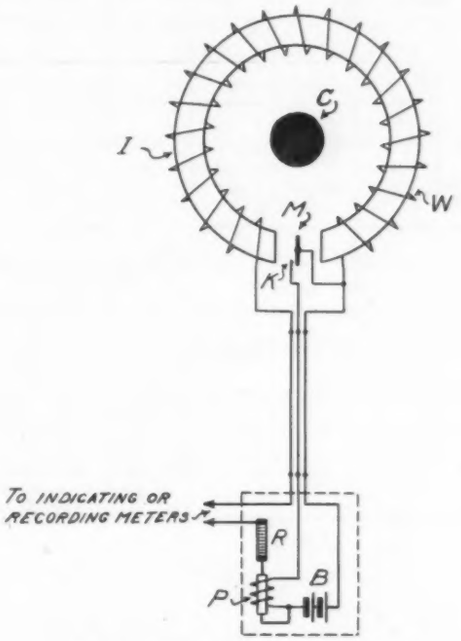

Fig. 1. Split Coil D.C. Ratio Relay.

A long step has been made in the forward progress of the electrical world by the application of split coil measurement to direct current line loads.

This method combines accuracy, flexibility, and ease of operation in measuring direct current loads without opening the circuit or in any way interfering with the service, and without the cumbersome process of installing jumpers. This is especially useful in the case of large power companies for a rapid and accurate check of the meters on the outgoing feeders at the substation, or on the meters of large consumers. It gives direct readings in amperes of the current flowing through any conductor about which the split coil of the instrument is clamped. The wide range of operation covers current values from zero to 3000 amperes, thus eliminating the necessity for more than one instrument. This flexibility, together with the fact that the current value is indicated on a direct reading scale of uniform divisions, and the rapidity with which readings can be made, form a combination that will at once recommend the meter for practical use.

Two forms have been made up, one called the direct current ratio relay, is automatic in its operation, while the other known as the direct current line testing set is manipulated by the tester. The first device consists of the split coil to be clamped about the cable or conductor, a storage battery for sending the current through the split coil and thus creating a field to neutralize the flux due to the current in the cable, and a solenoid plunger which controls and regulates the current flowing through the windings of the split coil. This split coil shown in detail in Fig. 1, consists of an iron core (I) wrapped with many turns of fine wire. A hinge on one side allows the coil to be quickly slipped about the cable (C). It is then held in position by the insertion of the plug which completes the circuit through the coil and battery, and introduces a small air gap into the magnetic circuit of the coil. In this air gap is located a thin strip of nagnet steel (M) called the contactor,

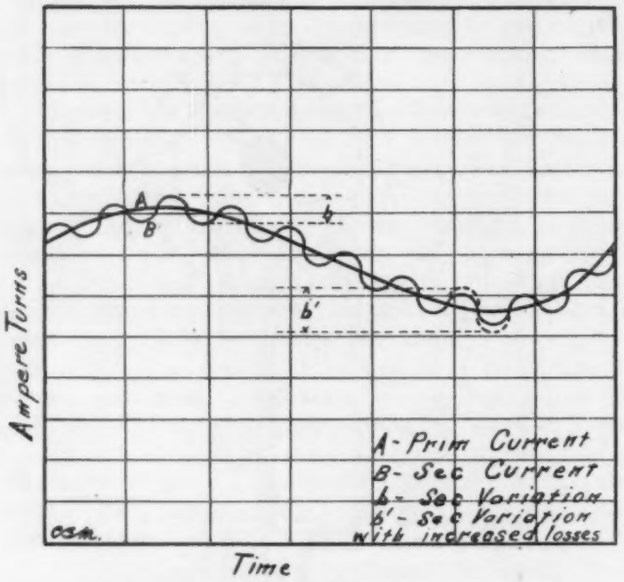

Fig. 2. Relationship of Secondary to Primary Currents.

which is affected by the magnetic fields about it. This contactor opens and closes an auxiliary circuit through the battery (B) and the windings of the solenoid (P), When the coil is placed over the cable, a magnetic flux is produced in the iron core which causes the contactor magnet to change its position so as to align itself in the magnetic field, thereby closing the auxiliary circuit at (K) and energizing the solenoid. The solenoid in turn acts upon the plunger and compresses the carbon disks (R) lowering the resistance in the secondary circuit and increasing the flow of current through the turns (W) of the split coil. The resulting flux due to this current in the secondary, tending to neutralize the flux produced by the primary line current, continues to increase, until it reaches a value such that the magnet contactor opens the auxiliary circuit, and relieves the pressure on the carbon disks by allowing the plunger to drop away. A consequent reduction of the secondary current takes place, and the primary flux again forces the contactor over to close the auxiliary circuit and increase the secondary current. This cycle is repeated automatically as long as the current flows through the primary cable, and the value of this current is found by taking the average of the readings of the ammeter.

Since the flux through the coil due to the winding (W) is dependent only upon the current value through this circuit, and in no way upon the voltage, an increase or decrease in the external resistance has no effect what-

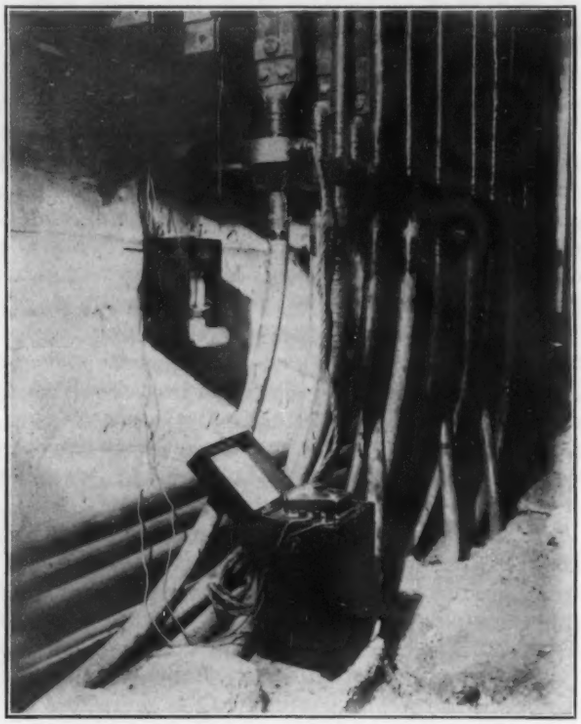

Fig. 3. Ratio Relay Coil, shown Strapped About Cable for Determining Current Flow.

ever upon the accuracy of the readings. This is true since the magnet contactor remains in position keeping the contact (K) closed until the ampere turns of the secondary and the consequent flux through the coil is equal to the ampere turns of and the flux produced by the line current, plus the very small losses of the instrument. The advantage of this condition is apparent, in that poor contacts in the circuit cannot produce an incorrect reading. Also an indicating meter only, or a recording meter only, or the two in series may be connected for checking one against the other.

The second form of the meter consists of the split coil and magnet contactor, the battery and meter and a small compression carbon or rheostat in the secondary, in series with the battery, meter and split coil windings. The rheostat is adjusted by the operator so that the primary and secondary flux alternately influence the contactor to flip from one side to the other, showing that the secondary ampere turns are either greater or less than the primary. This hand regulation replaces the automatic operation of Fig. 1.

The hand controlled meter is more compact and is proportionately more portable for line testing work. The automatic meter eliminates the personal equation of the operator and permits of the installation of the recording meter, thus giving a continuous record of the load throughout any period of time.

The principle of operation of the ratio relay is nearly identical with that of the a.c. current transformer. In the latter the current through the primary produces a flux in the iron core which in turn produces a current in the secondary, the size of this current being

such that the ampere turns of the primary and the secondary are the same, except for the slight losses due to hysteresis and eddy currents in the core, and small copper losses. These losses can be partially compensated for by making the secondary turns slightly less than the theoretical number necessary for the given ratio of transformation.

In the ratio relay the same principle is involved, but the secondary current is supplied by an auxiliary source, and not by induction. Since the flux due to the secondary current fluctuates regularly, so that the magnet contactor is affected alternately by the primary and secondary flux, the ratio of transformation is exactly equal to the ratio of secondary and primary turns. An increase in the core losses of the direct current split coil does not mean an inaccurate reading on the meter, but simply a wider range of fluctuation of the secondary current, the average remaining the same as before at the correct value. Fig. 2 shows the relation of the secondary to the primary currents. Thus it will be seen that the inherent regulation of the ratio relay is better than that of the a.c. current transformer which is so widely and satisfactorily used.

Exhaustive tests upon the ratio of transformation by the two watt-hour-meter method have demonstrated that its accuracy is well within the limits of mechanical accuracy. In this method two watt-hour-meters are connected in series and adjusted to give equal readings. One is then connected in the primary and the other in the secondary circuit of the ratio relay, a primary being provided for the core consisting of a coil of as many turns as the secondary making the ratio 1 to 1, the relative registration then showing the ratio of operation of the split coil. In this way it has been determined that the error of the apparatus is only a small fraction of one per cent. Consequently the meter is admirably adapted for precision measurements of large d.c. loads. The field of precision measurements on small d.c. loads is open for the relay by the simple process of looping the conductor through the coil until the ampere turns are sufficient to give a reading on the meter, and dividing this reading by the number of turns about the coil, which gives the line amperage.

In testing three wire meters the old method of installing a shunt in each side of the line required simultaneous readings. The ratio relay combines the two readings automatically, provided both sides of the line are run through the coil, just as both legs would be run through a current transformer, thus making it practicable for one man to make the tests instead of two as before. In this way also it is possible to combine any two circuits so as to give one reading on the meter.

The apparatus is particularly well adapted for use in electrolysis work, since the current flowing through any pipe, conduit or cable can be ascertained by slipping the coil about the conductor. In this work it would be impossible to open the conductor for the insertion of an ammeter, and the calculation of the current by voltage drop is unreliable, due to variations in resistance, or the resistance being unknown. Therefore the ratio relay fills a long felt need by providing a speedy and reliable means of ascertaining the current flow in electrolysis investigations. The presence of iron in the vicinity of the coil has no effect upon the working of the apparatus. This is advantageous because a cable enclosed in an iron pipe can be tested for electrolysis currents or load as well as any other.

The simple operation of the instrument is illustrated in Fig. 3, which shows the meter in actual operation on one of the outgoing feeders of a large direct current station.

The instrument is the invention of Mr. Otto A. Knopp of the engineering department of the Pacific Gas & Electric Company.

A SQUARE DEAL TO UTILITY COMPANIES.

The Portland Oregonian in its chief editorial of October 18th had the following to say concerning the city's attitude in local street railway problems:

"It ought not to be necessary to say one word in support of the representations of Mr. C. M. Clark of the Portland Railway, Light & Power Company. They reflect the the most elementary justice imaginable. The enterprise which he represents has made its investments in Portland on a contractual basis. It has agreed in return for certain privileges to provide certain service for the public, to pay certain taxes, to do certain paving, to submit to certain other exactions upon its revenues.

"Now appears another transportation service which assumes a heaven-born right to all the privileges granted the street railway company, in return for which it gives less adequate service and submits to no extraordinary exactions. It becomes an active competitor of the regulated service; it operates only on profitable routes; it seizes the streets which, through the sole exertion of the street railway company, have become the popular revenues of travel; its service is intermittent; it possesses no financial responsibility which may be called upon to compensate for injuries committed by it; it produces nothing; it surrenders nothing to the public; it is merely with ungracious tolerance permitted to take a part of that which the city has in spirit or by implication already granted to the street railway company and for which the city is being paid in hard cash.

"Let it be emphasized: The city of Portland has actually bartered and sold to the Portland Railway, Light & Power Company a certain thing of value. Yet it presents as a free gift to others, not a similar thing, not a corresponding thing, but the same thing that it has already sold and for which it is receiving regular payment. For the jitney builds up no traffic of its own. It does not pioneer in new districts. It does not traverse streets not already served with transportation. It goes into the field already occupied and grabs the best in sight.

"The failure of Portland to regulate the jitneys—to tax them on the same basis as the street railway is taxed, to require them to bear a portion of paving costs as does the street railway, to collect from them a bridge toll, to compel them to give transfers, to give service where service is needed, to insist that they be bonded for protection of their patrons—this failure has been termed an exhibition of bad faith, as one of unfairness toward invested capital. It is worse. It is downright dishonesty."

TESTS OF IRRIGATION PUMPING PLANTS SUPPLIED BY THE SOUTHERN CALIFORNIA EDISON COMPANY.

BY R. H. CATES.

(This description of methods employed for testing pumps illustrates the service of a modern central station for its consumers. The author is power engineer with the Southern California Edison Company at Los Angeles.—The Editor.)

In connection with the sale of electric energy for irrigation, it is the practice of the Southern California Edison Company to make efficiency tests of pumping installations. This is done as a part of the service of this company for the purpose of advising the consumers concerning the results being obtained by their plants and as a basis for recommending changes which will produce higher efficiencies or better operation.

A permanent testing department is maintained for the purpose of carrying on this class of work, and this department is equipped with all apparatus necessary to

PUMPING PLANT TEST

Plant ..... District ..... Date .....

ENGINE ..... H.P. ..... Rated R.P.M. ..... Measured R.P.M. ..... Pulley Dia. ..... Face .....

Eng. Cyl. Dia. ..... Length of Stroke ..... Kind of Fuel ..... Gals. per. Hr. .....

Price of Fuel ..... I. H. P. ..... B. H.P. ..... Kind of Belt ..... Belt Speed Ft. per Min. .....

MOTOR ..... H. P. ..... Voltage ..... Rated R. P. M. ..... Measured R. P. M. .....

Pulley Dia. ..... Face ..... Shaft ..... Keyway ..... Serial No. .....

METER No. ..... Type ..... Amp. ..... Volts ..... Disk. K .....

Rev. ..... Sec. ..... Current Trans. Ratio ..... Pot. Trans. Ratio ..... K. W. Input .....

KIND OF PUMP ..... Size ..... No. of Stages ..... Shop No. .....

Pulley Dia. ..... Face ..... R. P. M. ..... Diam. of Impeller .....

Pump Shafting Length ..... Diam. ..... No. of Bearings ..... Width of Spreader .....

Dia. of Cylinder ..... Length of Stroke ..... Size of Rod ..... Size of Tube .....

No. Strokes per Min. ..... Ratio of Gears ..... Distance "C" to "C" of Pulleys .....

Depth of Pit ..... Size ..... Inside Diam. of Discharge Pipe ..... Inside Area Sq. In. .....

Vacuum ..... Measured Lift ..... Pressure ..... Total Head .....

Flow Meter Readings ..... K= ..... G. P. M. ..... M. I. ..... M. I. per K. W. Input .....

Type of Weir ..... H= ..... L= .....

K. W. per M. I. 24 Hr. ..... Pump Eff. ..... Overall Eff. ..... Motor Eff. ..... Belt Loss .....

Kind of Crop ..... No. Acres under Irrigation .....

TEST	METER REV.	METER SEC.	PUMP R.P.M.	MOTOR R.P.M.	F. M.	M. I.	M. I. PER K. W.	LIFT	PUMP EFF.		

Remarks and Recommendations:

Fig. 1. Adverse and Reverse of Form for Test Data.

obtain complete data regarding pump efficiency, motor characteristics, or any other information which it is thought may aid in improving conditions of operation. The manufacturers of pumping machinery co-operate with this department to the fullest extent, and many data are obtained of great value to the consumer, the manufacturer and the Edison Company.

As a general rule, all new plants are tested when installed, and old plants are tested as may be necessary whenever service conditions are in any way unsatisfactory.

When service is installed, the consumer is instructed as far as possible in determining the input to his motor by timing the speed of the meter disk, thus enabling him to note quickly any radical change in conditions before it has had time to materially effect the cost of operation. When any change is apparent, the consumer reports such change to the company's local agent, who in turn calls for the services of an engineer from the power engineering department in Los Angeles.

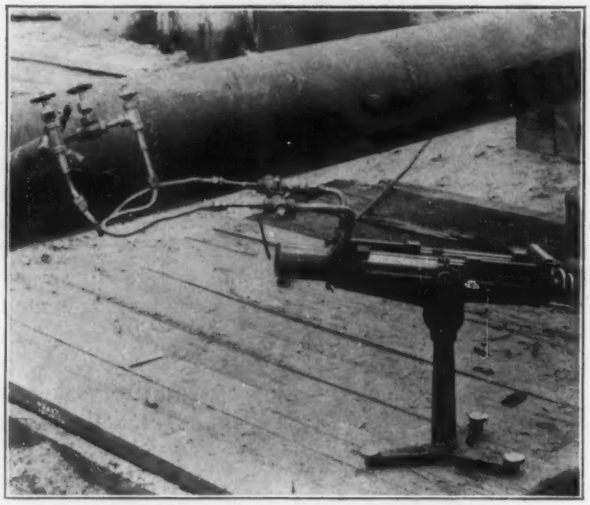

Fig. 2. Flow Meter Testing Equipment.

The data collected for each test is indicated by the form used for record, shown in Fig. 1. Spaces are provided for both engines and motor tests. Engine plants are frequently tested before they are replacecd with motors, the records being placed on file for future use.

Owing to the various conditions existing in different parts of the territory served, all types of pumps are in use. The spaces for the pump description were planned to give the necessary data on any type of pump.

The method employed in measurement of discharge depends on conditions found at each plant. In many instances weirs, concrete reservoirs, or tanks are installed, and in cases where these are properly constructed, they are used in obtaining the discharge. Many plants discharge directly into pipe lines and in such cases, the General Electric water flow meter is used.

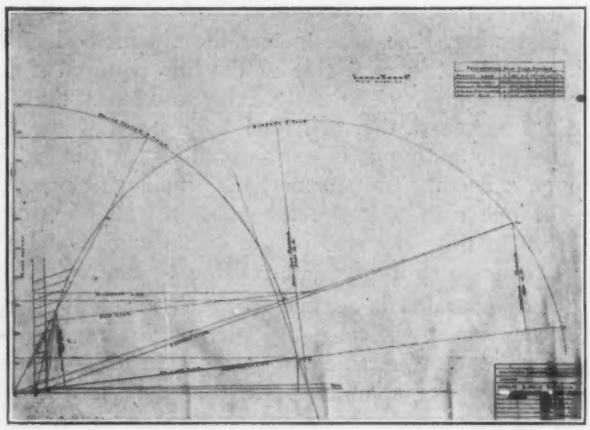

Fig. 3. Circle Diagram.

Tin pipe with brass unions soldered to each end, are used in connecting up this meter and pet cocks placed at various points on the instrument is an easy method of freeing the piping from air pockets.

This instrument set up for operation, is shown in Fig. 2. The discharge pipe is drilled and tapped at the

proper point for three-quarter inch plug, the inside diameter of the pipe being carefully measured before inserting the flow meter plug.

The particular instrument used in our work is designed in such a way that the U tube containing the mercury may be tilted and operated at an angle which will give about 2½ times the reading obtainable with the tube in a vertical position. The instrument is calibrated for use at this angle.

As the majority of the plants discharge at a low velocity, this feature makes it much more accurate than some of the type in general use which read only in a vertical position. Our engineers have checked this instrument carefully with weirs, and by checking with the contents of steel and concrete tanks, find it reliable when a reasonable velocity of discharge is obtainable. In cases where the discharge velocity is extremely low, the discharge pipe is carried to a portable weir.

The electric meter department makes routine tests of all power meters in the various districts from time to time, and as induction motors are used on all pumping plants, the power input is ordinarily obtained by timing the revolutions on the disk of the meter used at the plants. In special tests portable poly-phase test meters are used.

The lift is obtained in various ways, depending on the character of the installation.

As the pump manufacturer uses his own judgment as to size of suction and discharge pipes to the surface of the ground, it is not customary to make any allowance for friction in the system from the water level to this point. Where water is discharged at a higher level, calibrated pressure gages are used at the surface and the measured lift from the water level to the gage is added to complete the total lift, unless otherwise specified in the manufacturers' guarantee. An electric sounder has been developed to obtain the lift from the pumping level to the surface where deep well turbines are installed in well casings.

As the space between the turbine column and the well casing is limited, it is necessary to use a very small sounder, and as the surface of the water in this casing is often covered with several inches of oil from the lubricating system, the sounder must be operative after its point has passed through this oil. The sounder used by our department is constructed as follows:

A hard wood box having one compartment containing a 25,000 ohm Holtzer Cabot magneto and another containing about four hundred feet of No. 22 pothead wire on a spool is used, the inner end of the wire being attached to a shaft running through the center of the spool and resting in metal bearings on each side. One side bearing has a screw contact and a wire attached to one terminal of the magneto. A crank is attached to the shaft for the purpose of winding up the wire after it has been reeled off. The other terminal of the magneto is connected to the pump frame or discharge pipe by a short piece of wire. The sounder proper is attached to the outside end of the wire on the spool. The point of the sounder consists of a solid fibre rod, one-quarter inch in diameter and three inches long, through which a small hole is drilled and a No. 18 insulated copper wire about one foot long with about one-half inch of the insulation stripped from the end, is pushed into the fibre tip to a point about one inch from the lower end and a small hole is drilled through the side of the fibre tip opposite the bare end of the wire to prevent trapping air when the tip strikes the water. A piece of one-eighth inch lead pipe is pushed over the entire length of the No. 18 wire until it reaches the fibre tip, forming a fairly flexible section about one foot long and of sufficient weight to carry it down the well, this end piece being attached to the No. 22 pothead wire, and the joint covered with rubber tape first, then with friction tape. This sounder can be passed through a three-eighths inch hole drilled in the base of the turbine head, its contact with the surface of the water closing the circuit through the magneto and ringing the bell.

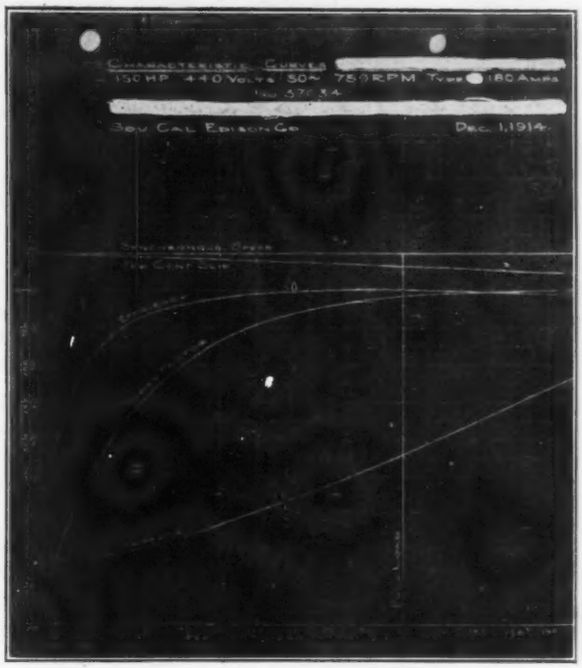

Fig. 4. Characteristic Curves of 150 h.p. Plant.

After lowering this sounder to the water level, it is withdrawn and the length measured with a steel tape.

In some cases air lines are placed in the well for the purpose of determining the pumping level. In this case a measured length of ¼ in. pipe is lowered into the well at the time the turbine is installed. This line runs to some known distance below the pump suction so that there is always several feet of water in the lower end while pumping. The upper end is fitted with a pressure gage below which is placed an ordinary auto tire valve. Air is pumped through this valve until the pressure gage reads a maximum value, which reading determines the level of the water in the well casings. This reading is taken before starting the plant and after operating long enough to obtain constant results. These readings give the draw down due to pumping.

From the discharge, power input, and measured lift, thus obtained, the overall efficiency is calculated. This represents the power consumption for which the consumer pays.

In order to make more definite comparisons of the efficiencies of the pumps alone, the overall efficiency is divided by the efficiency of the motor and the estimated efficiency of transmission where pumps are not direct connected to motors. Vertical pumps and belt connections are used in the majority of installations in this ter-

ritory as the variation in pumping levels changes during the season, making speed changes very necessary from time to time.

The efficiencies of motors vary with the size and to some extent with voltage, but from general tests we find them to be about as follows:

10 to 15 h.p.	86 %	75 to 100 h.p.	90 %
15 to 25 h.p.	88 %	Over 100 h.p.	91.5%
50 to 75 h.p.	89 %		

These efficiencies are for 220 volt and 440 volt motors. The 2200 volt motor efficiencies are from one to two per cent lower than given above.

A belt loss of six per cent is used in all cases except where the belt is evidently worn or otherwise inefficient.

The water pumped is expressed in terms of miners' inches, as this is the unit in general use in this section. This is based on one-fiftieth of a second foot, or to nine gallons per minute.

In order to enable the consumer to express his power cost in terms of water secured, the miners' inches per kilowatts input is computed, also the kilowatts per miners' inch twenty-four hours, the latter enabling him to apply his power rate and obtain the cost per inch hour which is the usual basis for selling water in this territory.

The above methods are considered to give a resulting average accuracy in overall efficiency obtained within a few per cent in individual tests, the uncertainty as to efficiency of motor and belt reducing the accuracy somewhat.

In special cases where it is necessary to obtain more accurate results, the motor characteristics are obtained from certified copies of factory tests, or tests are made at the plant. In the latter case locked rotor readings are taken at various voltages, and a Specht circle diagram is drawn. From this diagram curves are plotted showing the motor characteristics. A circle diagram together with characteristic curves taken on a 150 h.p. plant is shown in Fig. 3 and Fig. 4.

The purpose of this department is to see that the consumer at all times gets the greatest possible water per kilowatt input, and it often happens that in certain sections of our territory, the available supply from a well varies during some portion of the pumping season, so the slowing of a pump down below its efficient capacity, and losing ten per cent in pump efficiency will decrease the pumping level 15 to 20 per cent, making the cost per inch hour less than with the original pump efficiency. For this reason, belted plants are desirable where water requirements vary throughout the pumping season.

No record of the cost per test on irrigation plants has been compiled, as the company also gives its consumers the advantage of engineering service in all kinds of industrial plants, and this feature has been no small factor in building up the large power load carried on their system.

The application of electric drive to irrigation plants enables the ranch owner to devote his entire time to his crops and other business pursuits, gives him the most value for his money, adds to his peace of mind, and I believe that the increased volume of business taken on in this field is a glowing testimonial that he appreciates the fact that electric power for pumping purposes is the ideal installation.

TEN COMMANDMENTS FOR IMPROVING PUBLIC RELATIONS.

One of the features of a recent convention of traction managers of the Doherty organization was the suggestion of ten commandments to be observed by corporation men in their dealings with the public. This suggestion was made by Frank R. Coates and the commandments were as follows:

"A kind word quietly spoken will make friends.

"Take the public into your confidence. Lay all cards face up on the table.

"Give service that is everything that the word implies.

"Treat your employees and the public as you would be treated. Apply the Golden Rule in business.

"Remember we are all human and likely to err. Be patient.

"Keep your property maintained as nearly as possible to the 100 per cent standard.

"Officials should become connected with civic uplift bodies. Be an active member. Do your share of the work. Don't hesitate to let the public know you. Be one of them.

"Corporation offices should be devoid of red tape, and the doors should be open to the public.

"Don't keep callers waiting too long.

"Keep promises. Don't make any that you can't keep."

BETTER USE MUST BE MADE OF OIL PRODUCTION.

Although the production of crude petroleum in California still continues to reach record breaking proportions, nevertheless it is doubtful if fuel oil will ever return again to the prices prevalent in the period prior to the breaking out of the international war. This increased price is already having a marked effect in the West by turning the thoughts of central station managers once again to hydroelectric development in preference to steam turbine units.

In a recent address delivered by Van H. Manning, Director of the Bureau of Mines before the Retail Merchants' Association, the critical situation of gasoline, its price and purity was thus summarized:

The Bureau of Mines is in entire sympathy with your campaign for purity in gasoline, and wishes to be of aid, not only to all of you, but to the entire country in this important matter.

We are today facing a serious condition in the petroleum industry. We have probably reached the summit of our crude oil production in this country. According to the United States Geological Survey, our future supply of petroleum is only sufficient to last us from twenty-seven to thirty years at the present rate of consumption. This does not take into consideration any increasing demand as the years go by. In order to supply the fuel for the future automobiles, it will be necessary to make better use of our crude oil production in the future than we have in the past.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

As recently as 1897 exclusive rights to develop power from Niagara at a dollar a horsepower year rental were going begging.

* * *

A department of logging engineering has been introduced at the Oregon Agricultural College in an effort to dignify, standardize and help bring recognition to the logging industry of the West.

* * *

It is said that there are about one hundred and twenty engineering schools in America. This number seems large until expressed as a ratio to the population or one engineering school to eight hundred thousand people.

* * *

Recent investigations show that an electro-deposit of zinc on steel or iron is the only one that will withstand atmospheric conditions for any length of time. Although nickel-plated iron is satisfactory for use indoors, when exposed to the weather it almost invariably rusts.

* * *

An executive decree in Honduras regulates the distribution of water and electric light and power in the municipalities of that country. These services are under the direction of the Department of Fomento, which publishes the regulations in a recent number of its Boletin.

* * *

An interesting comparison has been made of the performance of the present type steamer and the modern Diesel driven vessel. A saving in fuel amounting to nearly twenty thousand dollars was made without considering the saving in cargo and crew under the Diesel operated boat.

* * *

The waste of water used by cities is becoming appalling. Chicago alone, according to the report of its Commission of Public Works, should easily reduce its operating expense for water supply by seven hundred thousands per year. That city now consumes 236 gallons per capita per day.

* * *

Still another export record has been broken. The total value of goods shipped out of this country in September was over half a billion dollars, or three million more than the high water mark established in August. For the twelve month period exports have passed the five billion mark.

* * *

There has been a phenomenal demand for copper again in the last few weeks, chiefly in connection with the constant requirements of belligerent countries on the allies' side, and this has obviously done much to accelerate a further upward movement in prices for all kinds of material, whether of copper itself or allied products.

* * *

Absolute proof is established that Mars is inhabited. So said Dr. Percival Lowell, the noted founder of the Lowell Observatory at Flagstaff, Arizona, in a recent lecture in Berkeley, California. The so-called canals observed on Mars are geometric to a degree and are uniform throughout. Their length is measured in hundreds and thousands of miles. How insignificant would our far-famed irrigation and reclamation projects appear beside such monsters as these.

* * *

During the past 12 years the annual expenditures on the rural roads and bridges in the United States have increased from about $80,000,000 to about $282,000,000, or an increase of more than 250 per cent. During this same period the annual expenditures from state funds for road and bridge construction and maintenance have increased from $2,550,000 to $53,492,000, or almost 2000 per cent.

* * *

The marvelous lighting effects obtained at the Panama-Pacific Exposition have during the past year awakened a new international interest in illumination. The flood lighting of countless public buildings, new creations for street lighting systems, and the wonder of a night spectacle of Niagara Falls, combined with countless other accomplishments are easily traceable to this origin.

* * *

Even far-off Siam is feeling the world-wide campaign of "do it electrically." Recently His Majesty the King honored the Siam Electricity Company with his presence on the occasion of the opening of the new office building of the company. His majesty, amid other ostentatious ceremonies, was graciously pleased to sign his name in the visitors' book and later retired amid a volley of twenty-one fire rockets.

* * *

A recent issue of the General Electric Review thus concludes a discussion of the beneficent results that are being brought about by the electrification of the Rocky Mountain Division of the Chicago, Milwaukee & Puget Sound Railroad: "It requires no great stretch of the imagination to visualize the day when a continuous network of transmission lines will parallel the main railroads from the Eastern Rockies to the Pacific Coast, conserving water power by using it and benefiting the general public by lower rates, increased comfort in traveling, and an almost universal distribution of energy at less cost from 'white coal.'"

* * *

Engineers and others searching out opportunities in South America continue to pass southward. On the other hand, increasing numbers of persons bound from Argentina, notably Buenos Aires, for the United States are making the voyage by way of the canal. They go to Valparaiso by way of the Transandean Railway and embark there for the Canal Zone on one of the two lines plying between Chile and the Atlantic terminus of the canal. The voyage to Balboa takes about fifteen days, and close connections are usually made on the Isthmus with ships for the United States, which are at sea from five to eight days.

JOURNAL OF ELECTRICITY
POWER AND GAS

FOUNDED 1887

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each,	.25

NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

CONTENTS

Heat Energy and Electricity 355
By E. A. Wilcox.

Results of Last Year's Prosperity Week 357

A New Invention for Measuring Currents in Cables 357
By C. B. Merrick.

A Square Deal to Utility Companies 359

Tests of Irrigation Pumping Plants Supplied by the Southern California Edison Company 360
By R. H. Cates.

Better Use Must be Made of Oil Production 362

Ten Commandments for Improving Public Relations 362

Sparks—Current Facts, Figures and Fancy 363

Editorials 364
- Electric Heat in the Home and in the Industries.
- Single Tax.
- Measurement of Currents in Cables.

Personals 366

Meeting Notices 366
- Los Angeles Section A. S. M. E.
- Western Conference Board.
- San Francisco Electrical Development & Jovian League.
- Los Angeles Jovian Electric League.
- San Francisco A. I. E. E. and A. S. M. E. Sections.
- Portland Section A. I. E. E. and N. E. L. A.
- California Association of Electrical Contractors & Dealers.

New Catalogues 368

Book Review 368

News Notes 369

Electric Heat in the Home and in the Industries

Almost over night electrical applications both in the home and in the industries have grown to fabulous proportions.

Aside from the countless electric motor applications that have found their way into the home and into the industries, electric heating devices present a new and profitable phase of development.

Are you yourself doing everything in your power to aid in still further broadening the uses of electricity? Are you as a matter of fact familiar with the countless devices that are now put on the market by reputable firms for "doing it electrically?" If you are not already familiar with these devices read the following lines and become acquainted with them by name at least and at your earliest convenience find out for yourself how they are now revolutionizing the "old way" by substituting for it the modern Aladdin or method electrical.

The lamp socket originally designed and installed In the home for lighting purposes now finds extended uses for electric irons, stoves, chafing dishes, coffee percolators, tea samovars, tea kettles, table cooking outfits, electric grills, food warmers, plate warmers and hot closets, bake ovens, nursery milk warmers, curling iron heaters, warming pads, immersion heaters and other household devices. And in addition to these are also to be found in rapidly increasing quantities the electric range, household water heater and the electric heater for buildings.

Again, in the industries electricity is playing a most important role. Electric furnaces and low temperature ovens make the production and refining of metals and countless other applications a new and more efficient art. Electric welding and the operation of electric steam boilers are also finding increasing usefulness.

And then there is almost a countless list of general applications among the more important of which may be mentioned electrical incubating and brooding of chickens, automobile heaters, bacteriological incubators, bath cabinets, beer vat dryers, branding irons, button die heaters, can capping outfits, candy batch warmers, corn-popping machines, dryers of all kinds, embossing press heaters, engravers' stones, flask heaters, gilding wheel heaters, glove stretchers, glue pots, hatters' tools, heating units, hot plates, irons, linotype pots, liquid heaters, meat branders, metal melting devices, oil tempering baths, pallette die heaters, paper seal moisteners, paper warmers, peanut roasters, perforators, pipe thawers, pitch kettles, electrical shoe machinery, solder pots and irons, sterilizers, tire vulcanizers, water stills, weight reducers and yarn conditioners.

With this issue of the Journal is to be found the introductory article to a series that will appear in its columns from time to time on the all important subject of electric heating. The articles will cover the essential features of practically the complete range of electrical heat applications, some of which have been listed above.

No central station management or sales department should allow itself to go unposted on the rapid

rise in theory and practice of devices that operate electrically.

It is to be hoped that this broad campaign of educational enlightenment on the part of the Journal, looking to a deeper, fuller co-operative movement on the part of all interested in "doing it electrically," will still further result in placing the West without a peer among those who recognize the method electrical to be the best, the biggest and the last great effort of human evolution in its fight to economically minimize the burdens of the race.

Single Tax

As a means of solving the tax problems of Oregon and California the voters of those states are being asked to pass upon single tax measures at the polls next Tuesday. In Oregon, under the name of the "land rent tax amendment," and in California as the "land tax amendment" are two initiative measures whose intent is to authorize the taking for public use of the rental and site values of land. It is proposed that practically all the tax burden be carried by realty.

Upon superficial examination this plan appears to have much to commend it. Single tax, as prominently indorsed by Henry George and his followers is a beautiful theory. Its advocates are idealists sincerely trying to remedy some of the defects of the present system. It is based upon the premise that land values are created by society and that society should consequently reap the benefits. "The Lord giveth and the landlord taketh away." They hold that private ownership of land is wrong and should be penalized by the confiscation of all rents.

Yet, subjected to searching analysis, the premise will be found fallacious. Aboriginally all property was owned jointly by a tribe. But as men became more civilized they gradually recognized the necessity for individual possession in order to obviate constant bickering and to provide proper incentive to human endeavor. It is an underlying rule of human nature that men will not work to produce wealth unless they are given security to enjoy the fruits of their efforts. In those countries where government officials have power to seize any man's property the mass of the people are miserably poor, while wherever property rights are secure wealth is abundant. To abolish private property is to reverse the whole trend of human progress,—to turn back the hands of the clock. It is a general rule that the prosperity of a people increases in direct proportion to the security of possession and enjoyment accorded the individual. The confiscation of land values proposed by the single-taxes would not only ruin every large land owner but would destroy the security upon which savings banks and other investors are largely dependent.

Aside from the economic objection to single tax there is the fiscal one of its unsatisfactoriness as a basis for taxation. The pecuniary needs of a government fluctuate rapidly. Rents do not. In practice single tax would undoubtedly create a surplus one year and a deficit the following year.

The worst feature of the proposal, however, is the moral one. Single taxers boldly propose that the state repudiate its contracts for the sale of lands to individuals who paid their money in good faith and who are dependent upon the state guaranty of title. The state should set the example for its citizens. Such a wholesale repudiation of obligations cannot but have a pernicious effect on the people.

In addition to these economic, fiscal and moral objections there is also to be considered the matter of equity. It is manifestly unfair to penalize the unearned increment without some form of reward for decrement in value. As much money is lost by holding land as is gained. It is only the assured security of land investment that compensates for the loss that accrues as compared with any other compounded investment.

To obviate the chance of these injustices it becomes the duty of every fair-minded man to explain the error of the single tax to his neighbor and to cast his vote against it at Tuesday's election. Otherwise the commonwealth will retrograde, the citizens become shiftless and thrift a byword.

Measurement of Currents in Cables

The demands for continuity of service have made the accurate measurement of current flow in cables a matter of extreme difficulty. Indeed it may be well said that the methods that have been evolved until very recently have proved expensive and cumbersome. To insert the meter in series with the cable involves a shut down or much painstaking labor. On the other hand to operate the meter as a shunt has proved unreliable and has necessitated frequent standardization.

On another page of this issue will be found an account of a recent invention of an employe in the operating department of one of the Western central stations that embodies a new and accurate method for quickly ascertaining current flow in cables.

Briefly put the apparatus consists of a coil that may be quickly fastened about the cable in which the current flow is to be measured. Through the core of this coil a definite flux will pass that is being maintained by the current in the cable. An ingenious device is next provided whereby an equal and opposite flux may be created from an auxiliary storage battery. By neutralizing this flux the current flow in the cable is then easily ascertained.

While the ingenious principle involved is entirely new the meter as a whole bears a striking similarity to the a.c. current transformer and as a consequence it has a wide availability for checking meters on large loads, for checking three wire meters with one tester, for two conductor tests and for tests where electrolysis is involved.

The flexibility and ease of operation, including simplicity of setting up, rapidity of readings and the possibility of installing the meter at some distance from the line to be tested are also commendable features.

And finally the apparatus is especially fitted for precision measurements on large or medium scale. This may indeed be extended to small readings by looping the conductor about the coil.

The underlying principle means accurate results and this has been fully substantiated by tests.

PERSONALS

E. C. Kierstad of Milner, Idaho, has been appointed Statesman of the Jovian Order.

H. C. Jacobs of the Jacobs Electric Company has returned to Santa Rosa, Cal., from San Francisco.

H. J. Verfurth of the Central California Electric Company of Lindsay was a recent visitor at San Francisco.

F. G. Beck, assistant manager of the Ever Ready Company of San Francisco, has returned from an extended trip throughout the East.

W. I. Otis and **L. E. Sperry,** manufacturers' agents at San Francisco, recently returned from a two weeks' business trip to Los Angeles.

Otto B. Goldman has been appointed assistant professor of mechanical engineering at the Oregon Agricultural College, Corvallis, Oregon.

A. S. Moody, northwest manager of the Pacific States Electric Company, has been appointed Statesman of the Jovian Order for Oregon.

Jos. S. Thompson, president of the Pacific Electric Manufacturing Company, has returned from a ten days' trip throughout the Northwest.

Jas. B. Blair of the treasury department of the Westinghouse Electric & Manufacturing Company of Los Angeles, was a recent visitor at San Francisco.

Carl Uhden, chief engineer for the Washington Water Power Company of Spokane, has been appointed Statesman of the Jovian Order for Washington.

R. L. Cardiff, manager of the Coast Counties Gas & Electric Company of Santa Cruz, spent a few days in the latter part of the week at San Francisco.

R. L. Eltringham, electrical engineer for the Industrial Accident Commission, will make a tour of inspection of the southern part of California next week.

Thomas M. Stattler, formerly connected with the Pacific States Electric Company, has recently joined the sales force of the Thomas Day Company of San Francisco.

J. C. Kirkpatrick, president of National Pole Company of Escanava, Mich., was a recent visitor at San Francisco, and has left for Los Angeles, where he will stop for a few days before returning East.

G. R. G. Conway, formerly chief engineer and assistant general manager, and now consulting engineer for the British Columbia Electric Railway, Vancouver, B. C., has left for Mexico City, to represent the bondholders' committees of the Mexican Light & Power Company and the Mexico Tramways.

Murray Orrick, manager of sales for the Western Electric Company, has been elected Statesman of the Jovian Order for California. **H. N. Sessions** of the Southern California Edison Company, has been appointed First Tribune for Los Angeles, and **R. E. Fisher** of the Pacific Gas & Electric Company, First Tribune for San Francisco.

E. A. Wilcox, for several years commercial agent for the Great Shoshone & Twin Falls Water Power Company at Twin Falls, Idaho, and recently electric heating specialist for the Great Western Power Company at San Francisco, has been appointed manager of the Tulsa (Okla.) properties of the Public Service Company of Oklahoma.

Chas. T. Hutchinson was elected president of the Engineers' Club of San Francisco at the annual meeting on October 27th, **W. W. Shockley** first vice-president, **B. P. Legare** second vice-president, **A. H. Griswold** treasurer, and **C. E. Grunsky, Jr.,** secretary. The new directors are: **C. H. Snyder, A. E. Chandler** three years, **H. W. Crozier** two years, and **E. O. Shreve** one year.

F. C. Green was elected president of the Oregon Association of Electrical Contractors and Dealers at their annual meeting on October 11th; **E. W. Pierce,** vice-president and chairman of the finance committee; **R. G. Littler,** vice-president and chairman of the legislative committee; **S. C. Jaggar,** vice-president and chairman of the program committee, and **J. R. Tomlinson,** vice-president and chairman of the committee on relations with jobbers' associations.

MEETING NOTICES.

Los Angeles Section, A. S. M. E.

On Thursday, November 2, 1916, the American Society of Mechanical Engineers, Los Angeles Section, will hold a technical session at Christopher's, 741 S. Broadway, at 6 p. m. After the dinner E. T. Sederholm, formerly of the Nordberg Engineering Company, will deliver a paper on "Deep Mine Hoisting." The engineers of Los Angeles meet every Thursday for a 12 o'clock lunch at the roof garden of the Broadway Department Store. Ford W. Harris is secretary of the Los Angeles Section, American Society Mechanical Engineers.

Western Conference Board.

The delegates appointed by the various Pacific Coast Electrical Contractors' Associations to the board convened at San Francisco Oct. 26th, and formed permanent organization. Those present were: J. R. Tomlinson of the Oregon Association; G. E. Arbogast Southern California Association; H. C. Reid, California Association of Electrical Contractors and Dealers, and H. C. Rohrback of Washington Association. Mr. H. C. Reid was elected chairman and Mr. Tomlinson secretary-treasurer. Among various subjects considered and receiving favorable recommendation to the various state associations was the universal adoption of the use of "Trade Acceptances."

San Francisco Electrical Development and Jovian League.

As evidence of its influence in educating the public at large, as well as it members, the league at its October 25th meeting, made arrangements for speakers to address various schools and associations on electrical subjects. This constructive evidence should add greatly to the value of the league. Mr. S. V. Walton, as originator of the plan, was appointed chairman of the committee having this duty in charge. President Newbert received enthusiastic reports from the other committees having charge of the league's various activities, and all signs point to a most successful administration. H. V. Carter, as chairman of the day, introduced the Reverend Paul Smith, who gave an inspiring address on "Two Great Discoveries." His speech sparkled with epigrams and aphorisms, and was heartily applauded. His argument was based upon the brotherhood of men and the conservation of human values. He showed the application of these principles in solving the problems of capital and labor, the liquor question and inter-racial differences. He characterized the new era as one of service and not of exploitation, and urged the recognition of human values rather than property values.

Los Angeles Jovian Electric League.

H. E. Sherman, Jr., Southern California representative of the H. B. Squires Company, was chairman of the day at the luncheon held at Jahnke's Tavern, on October 25th. The guest of honor was Mrs. Estelle Lawton Lindsay, a member of the Los Angeles City Council. Her subject, "The New Friendship Between Men and Women," was unique, and it is needless to say, interesting. It dealt with an important question of the hour, "the suffrage movement," and explained a new friendship, which Mrs. Lindsay claims as her own discovery—a mutual understanding and co-operation, eventually eliminating the sex antagonism, which, she says, has been due largely to the vices of men and ignorance of women. Mrs. Lindsay is a brilliant speaker with a keen insight into human nature, and her talk served to correct many wrong

impressions in the minds of her hearers, and to place the much-discussed subject in a new and more favorable light, as was indicated by the prolonged applause which marked the close of her speech.

Former President Holland leaves shortly for San Francisco to accept a position with the Great Western Power Company, and President Morphy, voicing the sentiment of the league, expressed sincere regret on behalf of the league, and thanked him for the loyalty and devotion displayed during his term of office.

San Francisco A. I. E. E. and A. S. M. E. Sections.

At a joint meeting on the evening of October 27th, A. H. Babcock gave full explanation of the manner in which engineers can qualify for the Officers' Reserve Corps of the United States Army, and W. J. Davis, Jr., gave a lecture, illustrated by lantern slides, of the use of steam turbines and reduction gears for marine propulsion. After telling briefly of the turbine equipment of colliers, Mr. Davis discussed their use in battleships and cruisers, giving especial prominence to the equipment of the California, now building at the Mare Island Navy Yard. The California will be one of the wonders of the American navy. Not only will her propulsion be electric, but the same power will perform all services aboard, will fire the guns, place ammunition, hoist and lower boats, raise anchors, steer the vessel, operate ventilating blowers and do the work of the kitchen, even to peeling potatoes, grinding meat, freezing ice cream and washing dishes. Steam turbines of 28,000 h.p., burning oil fuel, will generate electricity. Each of the four screws will be driven at 175 r.p.m. by a 6700 h.p. induction motor. Steam will be supplied at 280 lb. boiler pressure to two 11,000 kw. turbo-generators. At a speed of 21 knots 26,100 h.p. will be required with a water rate of 11.4 lb. per b.h.p., at 15 knots, 8500 b.h.p. at 11.6 and at 13 knots 5700 b.h.p. at 11.65 lb. per b.h.p. Full details were also given regarding turbine propulsion of cargo ships. In subsequent discussion G. W. Dickie reviewed the history of the former equipment of vessels, stating that the present vogue in steam turbine was partly due to the inability of the manufacturers of reciprocating engines to make delivery. A. H. Babcock emphasized the coming importance of Diesel engine drive.

Portland Sections A. I. E. E. and N. E. L. A.

The first biweekly luncheon of the A. I. E. E., N. E. L. A. and the Oregon Society of Engineers was held in the Oregon Hotel, Portland, Ore., Wednesday noon, October 25, 1916. The luncheon was in charge of the Northwestern Electric Company. L. T. Merwin introduced W. E. Connor, acting chairman, who in turn introduced A. L. Mills, president of the First National Bank. Mr. Mills spoke in a general way upon the financial condition and future outlook of the Pacific Northwest, and stated that he knew conditions were better today than they were a few months ago, and that they would continue to improve for at least a year after the war came to a close. Then there was bound to be a great financial reaction, and the Pacific Northwest was bound to feel it, but in great deal less degree than the East. He said he firmly believed in financial, industrial and military preparedness, as Europe would put forth as great an effort industriously as she has in a military way, and that we must be in a position to take care of all of our people after the European war is over.

A. C. MacMicken gave a synopsis of what was going to be done in Portland to observe America's Electrical Week.

The Northwestern Electric Company furnished three prizes, which were given out to the winners of the following contests:

First—Five names were drawn from the members attending the luncheon and they were given small rubber balloons to inflate with their mouths. The first one breaking same was winner of the contest. Mr. Cook of the Ohio Brass Company won an electric grill.

Second—Five more names were drawn, and the contest now was to take a bite out of an apple suspended on a string without aid of your hands. Mr. Howe won an electric toaster.

Third—Again five more names were drawn and a feather-blowing contest was put on. Mr. Dennis won an electric water heater. Attendance 95.

Next luncheon on November 8, 1916, will be handled by the Oregon Society of Engineers, and the speaker of the day will be Mr. Fred F. Henshaw, United States Geological Survey, and his subject will be Hydrometric Work in Oregon."

California Association of Electrical Contractors and Dealers.

The regular monthly meeting of the association was held at the Palace Hotel, San Francisco, on the evening of October 26th, there being about 90 contractors and jobbers present.

C. F. Butte, as chairman of the meeting, first called upon Dr. J. H. Graves, who gave a brief address on "Compulsory Social Insurance," presenting the same argument as was published in these columns last week in the report of the Electrical Development and Jovian League at San Francisco.

A. H. Halloran, Pacific Coast representative of the Society for Electrical Development, then explained the purpose of America's Electrical Week and how it was to be observed throughout the country. He showed particularly the way in which electrical contractors may tie in and cash in locally on this national advertising campaign by co-operation with the society's committees in general activities and by making window and store displays and demonstrations. The necessity of attracting visitors to these exhibits by means of letters and newspaper advertising was emphasized, as was also the advisability of enthusing salesmen in the work. The essence of his remarks was contained in the thought that if the contractors did their part in participation they would gain their share in profits.

George H. Haller read a paper in which he made the assertion that no general rule was applicable for ascertaining overhead, claiming that some lines require a greater allowance for overhead than others. Likewise he thought that a uniform price schedule was impracticable and to combat price cutting on one article, such as a battery, he suggested that efforts be concentrated on a competing article, such as a bell ringing transformer. As a substitution for vicious cutting of prices on nationally advertised specialties as leaders, he suggested that prices be reduced on staples, or that the dealers make a special drive on a brand of their own.

Louis Levy then gave some interesting remarks on electrical merchandising, arguing against the practice of special sales. His experience showed that a 40 per cent margin was essential to retail dealers. With regard to advertising, he makes a practice of setting aside 2 per cent of his gross sales as a regular investment. He concluded with a strong argument in favor of fair treatment of competitors.

H. C. Reid then read an interesting paper on construction from a contractor's viewpoint, first giving credit to the jobber, central station and press for their help in improving the construction end of the business. He read an editorial from a recent issue of the Journal, entitled "A Loss There Was," and then amplified a number of points by showing the necessity for the contractor knowing the cost of doing business. He made an earnest plea for an overhead allowance of more than 10 per cent. He also advised systematizing of estimates and spoke briefly on unit costs, costs of warehousing and handling goods and legislative and municipal reforms.

In response to a request that he speak from the jobber's standpoint, W. S. Berry told of the success of the Telephone and Telegraph Society in educating its employes as to the aims of the companies and as to proper methods of doing

business. He stated that all jobbers are anxious to interest the public in different lines, and that the Pacific Coast jobbers look upon the dealer as the right channel for distributing goods. He also urged co-operation with the hardware dealers and department stores.

C. E. Wiggin spoke of the value of acquaintance and co-operation in promoting the good of the electrical business and bespoke a greater exercise of the spirit of brotherly love.

D. E. Harris stated that the jobbers are in accord with the policies outlined by the contractors and dealers and likewise suggested closer affiliation with the hardware men. He showed that the purpose of modern business is to satisfy and serve the customer and that this objective can be reached by closer co-operation.

S. V. Walton complimented the association on its progress in organization during the past two years and urged that more branches of the business be included and that the organization be still further perfected. With regard to America's Electrical Week, he stated that during that period the Pacific Gas & Electric Company would forget that it was in the gas business.

A. B. C. Dohrmann gave the principal address of the evening, treating on the problems of the dealer and retailer. He introduced his remarks by saying that the information that he acquired during the evening concerning America's Electrical Week more than repaid him for five years' dues in the association. Such work as is being done by the Society for Electrical Development would not be possible without organization and co-operation. He commended like action to the contractors, emphasizing the importance of patience in the achievement of results. He stated that it takes time to educate one another, but that, like the good will of a business, results are rapidly compounded. He defined efficiency or scientific management as being even more essential to success than standardization of prices. "Efficiency is knowing what you ought to do and then going ahead and doing it." He illustrated his remarks by the success of the Retail Jewelers' Association in California during the past six years. They first ascertained what was the cost of doing business and then acted accordingly. He said he never feared a competitor who was making money. He suggested that the organization help competitors to make money. He cited his own experience in directing ten retail stores and stated that during 1915 they sold $180,000 worth of electrical appliances, with a gross profit of 41 per cent. He emphatically stated that the cost of conducting a retail business requires the same percentage in a small as in a large business; this percentage averages 34 per cent. This means that manufacturers should give the dealers a chance to make a gross profit of at least 40 per cent. He stated that modern department stores no longer feature leaders, this being a relic of a bygone age. He particularly urged that the dealers take time to talk over matters with their competitors and agree upon a mutual basis for doing business. He concluded his remarks with favorable comment on the recent change in the attitude of the Government towards trade organizations, finally stating that electrical merchandise must be distributed through those channels most convenient to the distributer.

J. R. Tomlinson of Portland then spoke briefly of the good progress made in that commonwealth by the electrical contractors and dealers, briefly stating the purposes of the Western Conference Board.

H. C. Rohrbach of Tacoma, who was also in attendance at the meeting of the Western Conference Board, expressed the good wishes of the Washington Association of Electrical Contractors and Dealers.

G. E. Arbogast, representing the Southern California Electrical Contractors' and Dealers' Association, after commenting upon Mr. Dohrman's remarks, emphasized the necessity of a greater profit to be allowed the dealers by the manufacturers.

Frank Somers, president of the association, humorously reviewed the remarks of the previous speakers and urged immediate action in the matter of an increase of discount on heating appliances. He read a communication regarding the progress of the British Columbia Association.

Leroy Smith, secretary of the California State Hardware Association, explained that they were willing and anxious to co-operate with the electrical men. H. P. Newman spoke likewise for the Plumbers' Association.

The meeting was closed by an interesting address by Albert H. Elliott, who eulogized Mr. Dohrman's work in teaching retailers the necessity for making proper provision for overhead and profit. With regards to a recent trip throughout the Northwest, he showed that similar troubles confronted all the contractors of the territory and could be solved by more or less standard methods. He spoke particularly of the value of an association with strength and power enough to help its members. He suggested that the contractors through their association adopt fixed business policies and stand by them. There being no other business before the association, the meeting adjourned at a late hour.

NEW CATALOGUES.

"Railway Motor Gears and Pinions" is the title of Bulletin No. 44419 just issued by the General Electric Company.

The Bureau of Mines has just issued a most useful booklet of 110 pages on "Rescue and Recovery Operations in Mines After Fires and Explosions."

"How to Succeed as a Mazda Lamp Merchant" is the subject of a 160-page book just published by the National Electric Lamp Association of Cleveland, Ohio. This high-grade sales manual, "the experiences of those who have succeeded, compiled for merchandizers of National Mazda lamps," . . . "is simply a series of guide posts set up for the people who prefer to let others make their mistakes for them." It is made up of short, snappy talks by the leaders in the lamp business—W. G. McKittrick, H. M. Vanzwoll, C. W. Bender, J. E. Randall, J. A. Vandegrift, N. H. Boynton, T. K. Quinn, R. E. Scott and P. F. Bander. It covers every phase of the manufacture, distribution and sale of Mazda lamps of all styles and types. Its suggestions are valuable to any salesman, but particularly so to lamp salesmen. With everything to commend it and nothing to condemn it, this book should be in the hands of every electrical dealer.

BOOK REVIEW.

Examples in Alternating-Currents, Vol. I. By F. E. Austin, diagrams and tables. Edited and published by F. E. Austin of Hanover, N. H., and for sale at the Technical Book Shop in San Francisco. Price forty cents for cloth binding, and one dollar ten cents for flexible binding.

For the student who is looking for a clear, concise layout of problems that involve alternating current computations this is the book. While the book has been designed to assist the college student, it will be found valuable to those who are pursuing correspondence courses or who are attempting the study of the subject by themselves. The book starts with curves showing typical alternating current waves, and then builds up the mathematical treatment of alternating currents first by use of geometry, then trigonometry and finally calculus. The examples are well chosen and are clearly set forth. This is the second edition of the book.

NEWS NOTES

INCORPORATIONS.

POCATELLO, IDAHO.—Articles have been filed with the county recorder at Pocatello, Idaho, for the Electrical Machinery & Engineering Company. The purpose of the new concern is to construct, repair, install and build electrical appliances of all kinds, to act as electrical and mechanical engineers, and to receive and store electrical supplies.

SACRAMENTO, CAL.—The Honey Lake Valley Mutual Water Users' Association, capitalized at $1,600,000, has filed articles of incorporation. It is the object of the association as set forth in the articles to acquire and develop facilities for supplying water for irrigation and other beneficial purposes to shareholders at cost. The incorporators and directors for the first term are: C. W. Hallowell, W. D. Minckler, and William D. Minckler, Jr., of Susanville, and F. W. Collins and Carl J. Young of Reno

ILLUMINATION.

EPHRATA WASH.—The council has decided to install some new lights.

BAKER, ORE.—Work of installing cluster lights on Main street was started about November 1.

TULARE, CAL.—Bids for installation of an electrolier street lighting system will be received up to November 6th.

NEWPORT, WASH.—The Idaho Power & Concentrating Company is preparing to ask for a franchise to furnish light and power to Sandpoint.

BOZEMAN, MONT.—A franchise for a gas plant has been requested by R. W. Lylsle of Chicago, who contemplates constructing a $150,000 plant.

DALY CITY, CAL.—The supervisors have decided to install additional lights on El Camino Real south of Holy Cross Cemetery to South San Francisco line.

PHOENIX, ARIZ.—Voters of Phoenix defeated the proposition for the issuance of city bonds in the sum of $600,000 for a municipal electric light and gas plant.

KINGMAN, ARIZ.—The Desert Power & Water Company is rushing a line across the desert toward Chloride as fast as possible. It is believed that Chloride will have electric lights within three weeks.

TACOMA, WASH.—Bids are being received by the commissioner of light and water for furnishing $10,000 worth of incandescent lamps to be delivered according to specifications on file with the commission.

HOLLYWOOD, CAL.—The F. S. McEwan Electric Company of Santa Monica has been awarded the contract for installing ornamental lights on Hollywood boulevard, between Cherokee and Wilcox avenues.

CENTRALIA, WASH.—W. F. Sheppherd has purchased the L. A. Webb interests in the Central Light & Power Company, and is ready to improve the plant and system and to furnish light and power to Pe Ell.

WATTS, CAL.—The board of trustees has received a petition for the improvement of East Albert street by the installation of ornamental electroliers and has instructed the engineer to prepare a resolution of intention for same.

PORT ANGELES, WASH.—The bid of Chas. S. Kidder & Company, bankers of Chicago, for the $25,000 worth of electric light bonds offering a premium of $1025 was accepted as the best bid. The bonds are required to retire warrants and provide for extensions of the lighting system.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to November 13, for installing an addition to the system of street lighting in the Verdugo Lighting District, the work to be performed in conformity with any instructions which may be given by the Board.

SOUTH BEND, WASH.—The Willapa Power Company has just completed the installation of a modern street lighting system in South Bend which, according to F. R. Nettleton, manager of that company, puts that city in a class by itself on the lighting question—$3500 being expended on the work. Improvements planned by the company for next year include the construction of a dam and power plant four miles nearer the headwaters of the South Fork of Willapa River than the present plant and the building of a new power plant. These improvements will cost $35,000. This will give them 45 ft. head water with a developing capacity of 1200 h.p. A Jos. Leffel turbine wheel has been ordered through the Colby Engineering Company of Portland for the new plant. Also a 300 k.v.a. Western Electric generator. A suit is now pending between the Willapa Power Company and the city of Raymond over this site. The city claims it for a water source.

TRANSMISSION.

LA GRANDE, ORE.—J. Melville was awarded a contract for the city heating plant at $2383.

BANNING, CAL.—The light and power utility has purchased a site at Ramsey and Second streets and will erect a two-story building for office and shop purposes.

BUTTE, MONT.—A. A. Dockstader, city clerk, states that an ordinance has been passed granting a franchise to the Montana Power Company for heating and steam plant privileges in certain streets.

SEATTLE, WASH.—The purchase of a completely developed power plant at a cost of not to exceed $3,000,000 is proposed under the terms of an ordinance which has been introduced by Councilmen Thomson and Moore.

DAVENPORT, WASH.—The Washington Water Power Corporation has filed a petition with the county commissioners asking for a franchise to construct an electric transmission line along the county roads in Lincoln county.

OROVILLE, CAL.—Encouraged by the showing made at the Robinson mine at Granite basin in Plumas county, the United States Exploration Company is making elaborate plans for a continuation of development work this winter. The company plans to sink to the 400 ft. level. If the ore showing continues as good as it is now, by June next work will be started upon a 50 horsepower hydroelectric plant and upon a flotation plant capable of handling 100 tons of ore a day.

SAN LUIS OBISPO, CAL.—The Midland Counties Public Service Corporation is preparing to extend its power lines in various parts of this and Santa Barbara county, and are branching out for more business for their electric service. It is reported the parent company known as the San Joaquin Light & Power Company, has appropriated $300,000 for additions to the service. Arrangements are reported to have been made for establishing a branch line to Avila and that later the towns of Morro, Caucos and Cambria will be supplied.

SAN FRANCISCO, CAL.—The Northern California Power Company Cons., has taken an option for five years in Trinity county on the Weaverville Electric Company's plant, and will extend its line to Weaverville. It may also extend to Junction City, where connection will be made with the lines of the Western States Power Company, that serves Eureka. The Northern has just completed an extension of its lines from the substation at the Washington mine near French Gulch, to Lewiston, a distance over the mountains of eight miles.

TELEPHONE AND TELEGRAPH.

BILLINGS, MONT.—The Mountain States Telephone Company is spending $80,000 in telephone work here.

CENTRALIA, WASH.—The matter of granting franchise to the Pacific Telephone & Telegraph Company will be referred to the voters.

BOISE, IDAHO.—The project Mutual Telephone Company has filed an application to extend its telephone and electric light system in Rupert.

KENNEWICK, WASH.—An ordinance has been passed by the city council granting to A. F. Brown a franchise to extend the telephone and telegraph system in the city of Kennewick.

WENATCHEE, WASH.—E. H. MacDaniels, forest supervisor, has applied to the county commissioners of Chelan county for a franchise to operate a telephone line over the several roads.

BOISE, IDAHO.—The Project Mutual Telephone Company has filed application with the public utilities commission for permission to extend its telephone and electric light project over the Minidoka project.

SAN MATEO, CAL.—Judge Buck has signed a decree ordering the city of Hillsborough to reconvey to the Burlingame Land & Water Company three parcels of land in Burlingame Park. The original owners now want to sell it to the Pacific Telephone & Telegraph Company as a site for new telephone exchange.

MODESTO, CAL.—The local exchange plans to expend $10,000 for enlarging the telephone system. Plans have been received by Manager E. Garner, and call for three new lines from Modesto to Oakdale, Empire and Hughson. A 25-pair cable line will span Dry Creek. The open wire work on Needham avenue will be replaced with lead covered cable, 200 ft. beyond the city limits.

TRANSPORTATION.

THREE FORKS, MINN.—The power company will erect a 75x85 ft. brick building.

SEATTLE, WASH.—The sum of $100,000 will be expended by the Seattle, Renton & Southern Railway in the construction of track and paving of street intersections in the Genessee street extension, and the construction of tracks on Dearborn.

TACOMA, WASH.—The Tacoma Railway & Power Company will spend several hundred thousand dollars on work of remodeling the car barn building at the corner of Thirteenth street to provide new general offices. The street car company will make other improvements as follows: Extension of Pacific avenue line from South Thirty-fifth to South Forty-eighth street, and the construction of South Tacoma tracks over the Tacoma avenue fill.

SPOKANE, WASH.—A preliminary announcement of the electrification of the Great Northern Railway Company was made in the columns of the Journal of October 21, 1916. It is now further announced that this company is to develop the Chelan River and Lake Chelan hydroelectric power scheme the coming year to develop 150,000 h.p. to operate the company's lines from Spokane to Seattle. It is also possible that the coast line of the Great Northern between Vancouver, B. C., and Portland will be included in the development. This would mean the electrification of 500 miles of line and the expenditure of $16,000,000 to $20,000,000.

IRRIGATION.

PARADISE, CAL.—As all the proceedings of the irrigation board have been adjudged legal, petitions calling for a bond election for the district will be in circulation in the near future.

SACRAMENTO, CAL.—John D. Guerraz of Edendale, Santa Clara county, has applied for permission to appropriate waters of a small stream in Piercy subdivision, near Edendale for irrigation of 40 acres.

STOCKTON, CAL.—At a recent meeting the council planned for the installation of a pumping plant at Yosemite lake. As the present system cannot handle overflow during high water, a centrifugal pump will be installed.

LINDSAY, CAL.—The bonds of the Lindsay-Strathmore irrigation district, in the sum of $1,400,000 have been sold to Harne & Co., of Los Angeles at par. Mr. Kennedy, the contractor, states that construction work is progressing rapidly.

OWENYO, CAL.—Geo. J. Evans of Lone Pine and Owenyo has applied for permission to appropriate water in two different places for agricultural purposes in Inyo county; one from Waucoba Creek and Lead Canyon Springs, and the other from Upper Warm Springs, tributary to Lower Warm Springs.

SACRAMENTO, CAL.—W. F. Fowler of Willows has applied for permission to appropriate 250 cubic feet per second of the waters of the Sacramento River for rice culture on 14,000 acres. The water will be raised by electrically-driven pumps to the main canal which is given as 10 miles in length. The proposed works will cost, at an estimate, $180,000.

ALPAUGH, CAL.—The work on the different lines of development undertaken by the irrigation district is progressing rapidly. The pipes for the domestic water system are already laid. The foundation for the 65,000 gallon tank is finished and work has been started on erecting the tower. The reservoir is ready for the concrete. Two of the pumping plants at Smyrna are already finished.

ELLENSBURG, WASH.—C. W. Johnstone, secretary of the Kittitas Reclamation District, commonly known as the High Line Canal District, announced that the directors had granted an option on the $5,000,000 bond issue to a syndicate headed by the Twohy Bros., contracting firm of Spokane and Portland. The option calls for the construction of the entire canal projected by the syndicate, which is to take the bond issue as pay.

FRESNO, CAL.—The proposition to reclaim 262,000 acres of the Tulare Lake basin and construct a reservoir and canals to hold the lake waters for irrigation purposes, at a cost of $6,000,000, will soon be presented to the State Reclamation Commission. It is planned to confine the lake to a resorvoir covering 20,000 acres, to lead the water into the reservoir from the various rivers and streams flowing in to the lake, and to provide canals to carry off the surplus water.

DIXON, CAL.—A meeting was held here last week to consider data regarding irrigation and comparative facts and figures from this and other irrigated sections of the state. If it seems feasible, and the time opportune, steps will be taken for the formation of the Dixon Irrigation District, the object of which will be to supply cheaper and more abundant water than is now had under the pumping plant plan. C. H. Loveland, R. W. Hawley and H. A. Whitney, engineers, have made superficial examination of dam sites and reservoirs. They report three possible reservoir and dam sites.

SAN FRANCISCO, CAL.—The Landis Bros. of San Francisco have applied to the State Water Commission for permission to appropriate 100,000 acre feet per annum of the waters of Dry Creek, tributary to Mokelumne River, in San Joaquin and Sacramento counties. The diversion proposes a concrete multiple arch dam 60 ft. high, 1400 ft. on top and 1200 ft. on bottom, which shall serve the purpose of both storage and diversion dam. This it is proposed to locate on the Arroyo Seco ranch. The estimated cost of the project is given as $1,000,000, and it is contemplated to water 100,000 acres. The commission has allowed the applicants until May 1, 1917, to file complete data and maps.